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Brief History of ORNL

In The Beginning

Most of the national laboratories had their roots in the massive wartime Manhattan project effort to build the atomic bomb. Originally named Clinton Laboratories, ORNL was established in 1943 as a pilot plant for the production and chemical recovery of plutonium; the Laboratory quickly grew into one of the major wartime nuclear research facilities. During the war, Clinton Laboratories not only successfully accomplished its first mission—demonstrating the safe production of plutonium—but also trained technical personnel to operate the large plutonium production plant at Hanford, produced radioisotopes for research, studied the medical and biological problems associated with using radioactive materials, and conducted basic nuclear research.

Recognizing the tremendous scientific strength of the nuclear research facilities that the war effort brought together, a government Advisory Committee on Research and Development first proposed the concept of the national laboratories to carry on with nuclear research and development. Specifically, the Advisory Committee recommended a scope of work that inc advanced nuclear studies and further R&D in the production of fissionable materials and ~~useful~~ nuclear power. The purpose of the national laboratories was to be in unclassified fundamental research that required equipment too costly for an individual university or industry (Hewlett and Anderson, 1962).

On January 1, 1947, the Atomic Energy Commission (created by the Atomic Energy Act of 1946) assumed responsibility for the atomic energy program, including the Clinton Laboratories. The transition period from

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the Manhattan Project to AEC operation was a time of confusion and uncertainty for the new national laboratories (but especially for Clinton Laboratories) as the peacetime directions and responsibilities of the new agency and its research facilities were ironed out. Although Clinton Laboratories had already proven its capabilities as a nuclear research facility, several key advisors (including Oppenheimer) questioned whether the Laboratory should be kept ~~one~~ open. Clinton Laboratories' remote geographical location, away from any large university community, made it seem an inappropriate place for a national laboratory. The AEC did not decide to close Clinton, but also did not clarify its mission, leadership, or contractor affiliation until January 1, 1948. At that time, Union Carbide took over as the Lab's operating contractor; Clinton was renamed the Oak Ridge National Laboratory; and the AEC directed ORNL to concentrate on basic research, chemical technology, and isotope production and research, giving ORNL only a ~~secondary (chemical technology)~~ role in reactor development (Leich and Lambright, 1975; Thompson, 1963).

Peaceful Use of Atomic Energy

ORNL's critics underestimated the tenacity and commitment of the scientists and engineers that remained at ORNL. The next decade was a time of growth and maturing for ORNL, which saw as its basic unifying purpose, the safe, economical production of nuclear power. Oak Ridge became the center for radioisotope production and research. The Biology Division ~~was~~ had been started under the leadership of Dr. Alexander Hollaender. In the late 1940's, ORNL expanded its heavy, applied development programs to produce fissionable materials and to work toward the goal of

practical nuclear power. The physical sciences programs, which were broadened to support the development work, used the unique scientific instruments and staff at ORNL to study fundamental nuclear processes. During this period, ORNL built, tested, and expanded the technological and the scientific base for practical nuclear energy production (Culler, 1947).

By the early 1950's, the production of nuclear power from fission had been demonstrated. ORNL built a nuclear reactor for exhibition at the First United Nations International Conference for Peaceful Uses of Atomic Energy (Geneva) in 1955. AEC's role as the principal user of its laboratories' nuclear developments changed to that of a coordinator, supporter, and regulator of a newly formed nuclear industry. Also in the mid-1950's, ORNL began to look at possible approaches to achieving controlled thermonuclear reactions, and the Thermonuclear Experimental Division was formed in 1957. The Ecological Science Section was formed in 1956 to investigate the effects of radioactivity on bacteria, fungi, mites, and insects in soil and fresh water.

The 1960's

The 1960's brought some changes in direction and focus for AEC and the Laboratory. In the early 1960's, the AEC's new role as a protector of public health and safety became more important as the nuclear industry developed. In response, ORNL expanded its nuclear reactor safety work. The goal of AEC's reactor development program became the development of an inexhaustible energy resource through breeding. In reactor development ORNL concentrated on the molten-salt reactor breeder concept and expanded its support of fast breeder reactor development. In

1962 with encouragement from AEC and permitted by an amendment to the Atomic Energy Act, ORNL first undertook work for other Federal agencies, including the National Aeronautical and Space Administration and the Department of the Interior. Support from the National Institutes of Health enabled ORNL to expand its cancer and basic biological research. With additional support from the National Science Foundation and the Environmental Protection Agency, ORNL's environmental program, begun in the mid-1950's, expanded to help meet the national concern for environmental protection and restoration. In the 1960's ORNL hired its first social scientsts (then to study people's attitudes about civil defense).

A National Energy Laboratory

The seventies brought more far-reaching changes that impacted and shaped the Laboratory's programs, including the national environmental movement and public opposition to nuclear energy; the 1973 Arab oil embargo and the resulting "energy crisis"; the change in the primary sponsoring agency from AEC to the Energy Research and Development Administration (and the Nuclear Regulatory Commission), and finally to the Department of Energy; and new leadership at the Laboratory. In 1970 the NSF-sponsored Environmental Program allowed ORNL to expand into more nonnuclear areas, including energy conservation, materials resources and recycling, environmental indices, and regional modeling. ORNL's work on environmental impact statements began in 1971. The Energy Division was formed in 1974. With ERDA as ORNL's new primary funding agency, the Laboratory became more of a national energy (rather than a nuclear) laboratory. ORNL roles for ERDA (and later for DOE) were in developing new energy technologies (leading to a growth in ORNL's technology programs but not in the basic sciences areas).

The Here and Now

ORNL's purpose and programs are being redefined again in this decade, reflecting new national needs and the Administration's shift in R&D priorities for the national laboratories. The push of the seventies to develop energy technologies rapidly to commercialization has been replaced by the philosophy that the energy problem can be handled by the economy's market forces. Near-term development should be left up to industry. Appropriate R&D roles for the national laboratories are in long-range basic research and in long-range, high-risk energy research and technology development. Funding for basic physical sciences programs is increasing, while biological research has suffered severe funding cuts. ORNL's extensive outside interactions (e.g., user facilities, subcontracting, training programs, and joint research projects) are being emphasized and expanded.

ORNL's Accomplishments

Since its inception in 1943, ORNL has made outstanding contributions in the physical sciences, life sciences, and engineering fields, related to the safe, economic production and use of energy. Roles assigned to ORNL have altered over the last forty years, as objectives have been accomplished or national needs have changed. Beginning with ORNL's first objective — demonstrating the safe production and chemical reco- re-cov-e very of plutonium — ORNL's roles have included developing safe chemical methods for reprocessing nuclear fuels, producing radioisotopes for scientific research and medical purposes, training people to operate reactors and chemical reprocessing facilities, developing economically competitive nuclear power systems, developing advanced nuclear power

systems such as breeder and fusion reactors, developing nonnuclear energy technologies to ensure sufficient energy supplies, and conducting basic physical sciences and energy-related life sciences research (Krause, 1976). Some of ORNL's more notable accomplishments include[1]:

- Development of techniques for ~~establishing~~ estimating radiation doses to humans — used world-wide;
- Development of advanced centrifuge for producing vaccines and rapid medical diagnoses — in wide-scale commercial use;
- Initiation of radionuclide production and development of radiopharmaceuticals — used extensively in field of medicine;
- The field of heavy-ion physics (founded at ORNL);
- Identification of phenomena and mechanisms of neutron radiation damage — crucial to development of commercial nuclear power;
- Development of theory and supporting data for design of heavy-section steel vessels — used in design of LWRs ~~in U.S.~~ and other countries; the United States
- Rapid and extensive assistance during and after the TMI incident;
- Development of processes for nuclear fuel reprocessing — now used throughout the world;
- Pioneering of neutral injection plasma heating for fusion devices; and ~~devi~~
- Development of instrumentation for monitoring carcinogens produced in coal conversion processes.

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[1]A more detailed list of accomplishments is provided in the Appendix.

From AEC to ERDA to DOE

Undoubtedly the biggest single change that has affected the roles and character of ORNL's work has been the shifts in sponsorship from AEC to ERDA to DOE. Each of these agencies was established for different purposes and each fit into the government structure differently. The Atomic Energy Commission's primary objective was to demonstrate safe, economical nuclear power generation, and it accomplished this purpose mainly through its national laboratories. The AEC worked closely in Congress with only one powerful committee — the Joint Committee on Atomic Energy. After this fairly straight-forward arrangement, the Energy Research and Development Administration and the Nuclear Regulatory Commission were established. Unlike AEC, ERDA did not advocate one technology but emphasized rapid development of all energy technologies to the point of commercialization. ERDA contained some old, familar AEC faces but also swallowed up programs and personnel from other agencies as well. No longer did ~~our~~ ORNL's sponsoring agency deal with only one Congressional committee; as the energy crisis became a major national concern, numerous Senate and House Committees took on energy responsibilities. ERDA still relied heavily on its laboratories to perform its R&D goals, but the laboratories' importance to ERDA was less than it was with AEC.

Finally, when the Department of Energy came into being, ~~our~~ ORNL's sponsoring agency was no longer primarily concerned with research and development. DOE encompasses all government energy functions — research, regulations, power administrations, petroleum reserves, information systems, etc. With these broadened responsibilities, DOE called on its

laboratories to do more non-R&D work (e.g., program management, energy information system validation). Again, DOE is dealing with a myriad of Congressional Committees due to its many different responsibilities; getting a consensus on directions for energy policy seems to be increasingly difficult. The national laboratories, which are primarily R&D institutions, are less important to the DOE than they were to either AEC or ~~and~~ ERDA.